

**WHAT IS CLAIMED:**

1. A method of modifying cell structure comprising:  
increasing the intracellular concentration of biliverdin  
5 reductase, or a fragment or variant thereof, in a mammalian cell under conditions  
effective to modify the structure of the mammalian cell.
2. The method according to claim 1, wherein the modified cell  
structure is enhanced cell size, actin microspike formation, polar cell morphology, or  
10 a combination thereof.
3. The method according claim 1 wherein said increasing  
comprises:  
15 introducing biliverdin reductase into the mammalian cell.
4. The method according claim 3 wherein said introducing  
comprises:  
20 contacting the mammalian cell with a delivery vehicle  
comprising biliverdin reductase.
5. The method according to claim 4 wherein the delivery vehicle  
comprises a fusion protein comprising biliverdin reductase and a ligand domain  
recognized by a receptor of the mammalian cell.
- 25 6. The method according to claim 4 wherein the delivery vehicle  
comprises a liposome containing biliverdin reductase.
7. The method according to claim 4 wherein the delivery vehicle  
comprises an enzymatically stable conjugate comprising a polymer and biliverdin  
30 reductase conjugated to the polymer.

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8. The method according to claim 1 wherein said increasing  
comprises:  
transforming the mammalian cell with a nucleic acid encoding  
biliverdin reductase under conditions effective for expression of the biliverdin  
5 reductase in the mammalian cell.

9. The method according to claim 8 wherein said transforming  
comprises:  
transfecting the mammalian cell with an infective  
transformation vector comprising the nucleic acid encoding biliverdin reductase.  
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10. The method according to claim 9 wherein the infective  
transformation vector is an adenovirus vector or a retrovirus vector.

11. The method according to claim 1 wherein the mammalian cell  
is a stem cell, a neuronal or glial cell, a vascular smooth muscle cell, a skeletal muscle  
cell, an epithelial cell, or a nucleated blood cell.  
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12. The method according to claim 1 wherein the mammalian cell  
is *in vitro*.  
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13. The method according to claim 1 wherein the mammalian cell  
is *in vivo*.

14. A method of *in vivo* tissue remodeling in a mammal  
comprising:  
delivering biliverdin reductase, or fragments or variants  
thereof, to one or more cells present at a site of tissue remodeling in a mammal,  
wherein said delivering increases the intracellular concentration of biliverdin  
30 reductase, or fragments or variants thereof, under conditions effective to modify the  
structure of the one or more cells at the site of tissue remodeling, thereby remodeling  
the tissue containing the one or more cells.

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15. The method according to claim 14, wherein the tissue is epithelial tissue, nerve tissue, muscular tissue, or connective tissue.

16. The method according to claim 14 wherein the one or more cells is a stem cell, a neuronal or glial cell, a vascular smooth muscle cell, a skeletal muscle cell, an epithelial cell, a nucleated blood cell, or a combination thereof.

17. The method according claim 14 wherein said delivering comprises:  
introducing biliverdin reductase into the one or more cells.

18. The method according claim 17 wherein said introducing comprises:  
contacting each of the one or more cells with a delivery vehicle comprising biliverdin reductase.

19. The method according to claim 18 wherein the delivery vehicle comprises a fusion protein comprising biliverdin reductase and a ligand domain recognized by a receptor of the one or more cells.

20. The method according to claim 18 wherein the delivery vehicle comprises a liposome containing biliverdin reductase.

21. The method according to claim 18 wherein the delivery vehicle comprises an enzymatically stable conjugate comprising a polymer and biliverdin reductase conjugated to the polymer.

22. The method according to claim 14 wherein said delivering comprises:  
transforming each of the one or more cells with a nucleic acid encoding biliverdin reductase under conditions effective for expression of the biliverdin reductase in the one or more cells.

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23. The method according to claim 22 wherein said transforming comprises:

transfecting each of the one or more cells with an infective transformation vector comprising the nucleic acid encoding biliverdin reductase.

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24. The method according to claim 23 wherein the infective transformation vector is an adenovirus vector or a retrovirus vector.

25. The method of repairing a damaged organ or organ system by performing said method of *in vivo* tissue remodeling according to claim 14, where the site of tissue remodeling is within the damaged organ or organ system.

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26. The method according to claim 25, wherein the organ or organ system is skin, liver, nervous system, cardiovascular system, or urogenital tract.

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